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**BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES**

Application Number: 09/895,153
Filing Date: July 02, 2001
Appellant(s): NEOH ET AL.

Mark J. Nuell
For Appellant

EXAMINER'S ANSWER

MAILED
AUG 01 2006
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This is in response to the appeal brief filed June 6, 2006 appealing from the Office action mailed December 6, 2005.

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(1) Real Party in Interest

A statement identifying by name the real party in interest is contained in the brief.

(2) Related Appeals and Interferences

The examiner is not aware of any related appeals, interferences, or judicial proceedings which will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

(3) Status of Claims

The statement of the status of claims contained in the brief is correct.

(4) Status of Amendments After Final

The appellant's statement of the status of amendments after final rejection contained in the brief is correct.

(5) Summary of Claimed Subject Matter

The summary of claimed subject matter contained in the brief is correct.

(6) Grounds of Rejection to be Reviewed on Appeal

The appellant's statement of the grounds of rejection to be reviewed on appeal is correct.

(7) Claims Appendix

The copy of the appealed claims contained in the Appendix to the brief is correct.

(8) Evidence Relied Upon

4,455,233	POHL ET AL	6-1984
4,414,080	WILLIAMS ET AL	11-1983
5,016,063	BERATAN ET AL	5-1991
JP 56026977 A	SATO ET AL	3-1981

(9) Grounds of Rejection

The following ground(s) of rejection are applicable to the appealed claims:

Claim 36 is rejected under 35 U.S.C. 103(a) as being unpatentable over Sato et al (JP56026977) in view of Pohl et al (US 4,455,233), Williams et al (US 4,414,080) and Beratan et al (US 5,016,063).

Sato et al disclose a method for preparing a **photochromic** film on a substrate comprising coating a 1st constituent such as viologen salt containing polymer to a substrate thereby forming a first film, drying the film, coating the dried film with a 2nd constituent such as polyvinyl alcohol for increasing **sensitivity** of the *photoreduction* (electron shift) reaction of viologen salt (electron acceptor) thereby forming a second film (See **Abstract**; Translation, page 8, P2), then irradiating both films with 200 W mercury lamp (claimed UV radiation) (See Translation, page 9, step a, page 10, step b). The films develop a *bright bluish violet color*, when irradiated with the lamp (See Abstract). In other words, upon exposure to near-ultraviolet radiation, polyvinyl alcohol polymer reduces viologen salt by acting as an **electron donor**, i.e. resulting laminate becomes electrically conductive (See Translation, page 3, P2). The high molecular weight viologen is formed by attaching viologen salt to a chloromethylated polystyrene (a polymer having a polyethylene backbone and pendant benzyl chloride groups, i.e. claimed benzyl chloride grafted polymer) by reacting 4,4' bipyridyl mono alkyl halide compound with benzyl chloride groups of the polymer.

Sato et al teach that

Sato et al fails to teach that (i) chloromethylated polystyrene (i.e. a polymer having a polyethylene backbone and pendant benzyl chloride groups benzyl chloride groups) can be obtained not only by chloromethylating a phenyl-containing polystyrene but also by grafting vinyl benzyl chloride onto non-phenyl-containing polymer such as polyethylene; (ii) a) the first viologen polymer film is formed by reacting 4,4' bipyridyl mono alkyl halide compound with a chloromethylated polymer *film* substrate; and b) an equimolar mixture of 4,4' bipyridine and p-

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xylene dihalide is used instead of 4,4' bi pyridyl mono aralkyl halide compound; (iii) instead of polyvinyl alcohol, polyaniline can be used as electron donor for coating the viologen salt layer.

As to (i), Pohl et al teach that pendant benzyl chloride groups can be easily grafted onto a polyethylene (non-phenyl-containing) substrate by irradiation the substrate in a solution of vinyl benzyl chloride (See column 8, lines 3-15).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to have prepared a polymer substrate of Sato et al having pendant benzyl chloride groups attached to a polyethylene backbone by irradiating a polyethylene substrate in a solution of vinyl benzyl chloride instead of chloromethylating polystyrene using $\text{CH}_3\text{OCH}_2\text{Cl}$ since Pohl et al teach that pendant benzyl chloride groups can be easily grafted onto a polyethylene (non-phenyl-containing) substrate by irradiation the substrate in a solution of vinyl benzyl chloride.

As to (ii) a), Williams et al teach that a film of a viologen polymer can be *formed* by reacting 4,4'-bipyridyl with benzyl halide groups of chloromethylated polymer (See column 8, lines 1-27) or with an equimolar amount of an organic dihalide at temperatures from about 20°C to 60°C (See column 6, lines 36-59) **either in the presence of a substrate or the preformed** viologen polymer can be cast, coated or laminated to the surface on the substrate (See column 7, lines 1-3). Williams et al teach that the resulting viologen polymer (See column 6, lines 3, 9-10) is electron permeable and charge carrying (See column 6, lines 9-11) and can be used for **photoelectrochemical electrodes** (See column 1, lines 13-15).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to have formed a first film of a viologen polymer in Sato et al in view of Pohl et al by reacting 4,4' bipyridyl mono aralkyl halide compound with a benzyl chloride grafted polymer *in the presence of the substrate*, instead of coating a *preformed* viologen polymer on the substrate such that **at least some** of the benzyl chloride grafted polymer would be deposited as a film on the substrate thereby forming benzyl chloride grafted film substrate so that the 4,4' bipyridyl mono aralkyl halide compound would react with the benzyl chloride grafted film substrate (as required by the claim) since Williams et al teach that a film of a viologen polymer can be formed by reacting 4,4'-bipyridyl with an equimolar amount of an organic dihalide either *in the presence of the substrate* or the *preformed* polymer can be cast, coated or laminated to the surface on the substrate.

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As to (ii) b), Williams et al teach that the electron permeable and charge carrying viologen polymer (See column 6, lines 9-11) for **photoelectrochemical electrodes** (See column 1, lines 13-15) can be formed *either* by reacting 4,4' bipyridyl with an equimolar amount of an organic dihalide (See column 6, lines 36-59) such as p-xylene dihalide (See column 7, lines 21-25) *or* by reacting 4,4' bipyridyl with benzyl chloride groups of polychloromethyl styrene polymer (See column 8, lines 25-40). As could be seen from structures (III) (See column 6, lines 55+) and (IV) (See column 8, lines 5-25) of Williams et al, each of p-xylene dihalide and benzyl halide *alkylates and quarternizes* 4,4' bipyridyl to viologen salts thereby *connecting* the formed viologen salts *to a molecule carrying the halide group*. Obviously, a viologen polymer having electron permeable and charge carrying properties for the use for **photoelectrochemical electrodes** may be formed by reacting both an equimolar amount of *p-xylene dihalide* and *benzyl halide* groups of a polychloromethylated polymer with 4,4' bipyridyl thereby *quarternizing* 4,4' bipyridyl to viologen salts and *connecting* the formed viologen salts to each other and to the polychloromethylated polymer.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to have used an equimolar amount of *p-xylene dihalide* to react with the benzyl chloride grafted polymer *in the presence of a substrate* in Sato et al in view of Pohl and Williams et al instead of or in addition to 4,4' bipyridyl mono aralkyl halide compound with the expectation of obtaining electron permeable and charge carrying viologen polymer connected to at least some of the benzyl chloride grafted polymer film substrate since Williams et al teach that each of p-xylene dihalide and benzyl halide *alkylates and quarternizes* 4,4' bipyridyl to viologen salts thereby *connecting* the formed viologen salts *to molecules carrying the halide group*. One of ordinary skill in the art would have reasonable expectation of success in using the resulting polymer instead of or in addition to a viologen polymer of Sato et al because the resulting viologen polymer would also undergo **photoreduction** because Williams et al teach that the viologen polymer film formed by their method is electron permeable and charge carrying and can be used in **photoelectrochemical** applications.

As to (iii), Beratan et al teach that polyaniline is suitable for the use as electron donor for viologen salt acceptor (See column 6, lines 16-30). **An electron shift follows photo-excitation** of the donor, an intermediate (placed between polyaniline and viologen salt acceptor) or the

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acceptor (See column 2, lines 29-33). Beratan et al teach that the use of intermediate provides *high efficiency* in moving charge compared to prior art without the use of the intermediate (See column 2, lines 1-2).

It is held that the selection of a known material based on its suitability for its intended use supported a prima facie obviousness determination in *Sinclair & Carroll Co. v. Interchemical Corp.*, 325 U.S. 327, 65 USPQ 297 (1945). See also *In re Leshin*, 227 F.2d 197, 125 USPQ 416 (CCPA 1960) (selection of a known plastic to make a container of a type made of plastics prior to the invention was held to be obvious); *Ryco, Inc. v. Ag-Bag Corp.*, 857 F.2d 1418, 8 USPQ2d 1323 (Fed. Cir. 1988).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to have used polyaniline as a donor in Sato et al since Beratan et al teach that polyaniline is suitable for the use as electron donor for viologen salt acceptor, and the use of intermediate provides *high efficiency* in moving charge compared to prior art without the use of the intermediate.

One of ordinary skill in the art would have reasonable expectation of success in using polyaniline for making photochromic composition excitable with near-ultraviolet radiation since Beratan et al teach that electron shift can be provided by photo-exciting either viologen or polyaniline under light (UV is not excluded) (See column 2, lines 25-28).

It is the Examiner's position that a polymeric film of Sato et al in view of Williams et al in view of Beratan et al would have claimed properties, e.g. is electrically conductive, since **it is prepared by a method substantially identical to that of claimed invention**. It is held that where the claimed and prior art products are identical or substantially identical in structure or composition, or are produced by identical or substantially identical processes, claimed properties or functions are presumed to be inherent. See MPEP 2111.02, 2112.01.

Moreover, since electroconductivity involves the process of moving available electrons, and since photoreduction of a viologen salt in a combination with polyaniline provides moving electrons, a polymer material containing them becomes electrically conductive, as required by claim 36. Williams teach that viologen salt polymer is electron permeable and charge carrying and can be applied on electrode, i.e. electroconductive.

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Note that Beratan et al disclose an **electron shift** device shown in Fig. 7 comprising an *electrode* 32, polymer chains 22 bonded to metal or doped semiconductor electrodes 32 and 34 via *covalent* bonds (See column 7, lines 33-46). Each polymer chain 22 comprises a plurality of monomeric repeat units 24, each monomeric repeat unit comprising at least three monomers, α , β , and γ . In FIG. 4a, the intermediate is labeled "beta" (β), the donor is labeled "gamma" (γ), and the acceptor is labeled "alpha" (α). In FIG. 4b, ruthenium tris(2,2'-bipyridine) is the intermediate, dimethyl *aniline* is the donor, and *methyl viologen* is the acceptor (See column 6, lines 16-26). As could be seen at FIG. 4b, the **methyl viologen acceptor is covalently attached to a film substrate having grafted benzyl groups $C_6H_5-CH_2-$** . Beratan et al do not disclose how the **methyl viologen acceptor is covalently attached to a film substrate having grafted benzyl groups $C_6H_5-CH_2-$** . It could be assumed, therefore, that customary methods have been used.

The prior art made of record and not relied upon is considered pertinent to applicant disclosure.

Robello et al (US 4,796,971) teach that 200W mercury lamp provides near-UV radiation (See column 42, lines 20-21).

(10) Response to Argument

Applicants' arguments filed 6/6/2006 have been fully considered but they are not persuasive.

(A) Applicants argue that Sato teaches that his films are homogeneous and slightly yellowish in color. His films develop a bright bluish violet color when irradiated, and then decolor upon heating or standing. POHL IMPROPERLY COMBINED. To remedy one deficiency of the Sato reference, the Examiner cites lines 3-15 in column 8 of Pohl. The cited portion of Pohl teaches grafting vinyl benzyl chloride onto polyethylene tubing "to render it suitable for conversion to ion-exchange form. Thereafter, the grafted tubing is aminated as set forth in [a] U.S. patent application entitled "Method And Apparatus For Mobile Phase Ion Chromatography And Membrane Suppression." The Examiner fails to indicate why a person of ordinary skill in the photochromic film art would look to the ion exchange chromatography art for ways to change the Sato photochromic technology. Even more significantly, the Examiner fails to indicate why one of ordinary skill in the art would be motivated to "irradiate" a polyethylene substrate in a

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solution of vinyl benzyl chloride instead of chloromethylating polystyrene using $\text{CH}_3\text{OCH}_2\text{Cl}$.

The Examiner disagrees. Sato et al use chromethylated polystyrene as a substrate for reacting with 4,4' bipyridyl compound. However, it is *well known* in **any** art, which uses as a substrate a polymer having grafted thereto benzyl halide groups, that chromethylating polystyrene and grafting vinyl benzyl chloride onto a polymer having no phenyl groups, are most used *conventional* techniques for making such a polymer substrate having grafted thereto benzyl halide groups. POHL is a secondary reference showing one of these *conventional* techniques in ion-exchange art. As was discussed above, Beratan et al do not even discuss how benzyl groups $\text{C}_6\text{H}_5\text{-CH}_2\text{-}$ (to which viologen salt is attached) at **FIG. 4b** are **grafted** to a film substrate. Since the benzyl group in Beratan et al is attached to *quarternized* nitrogen of viologen salt, clearly, the film substrate had benzyl halide group grafted onto the film substrate before reaction with 4,4' bipyridyl. In other words, it could be assumed that Beratan et al consider a technique of obtaining a benzyl halide *grafted* polymer film substrate being not inventive (i.e. *conventional*) that it was not worth a discussion.

In any case, Pohl is properly combined because any reference directing to a method of making a polymer substrate having grafted thereto benzyl halide groups would be reasonably pertinent to the particular problem with which the applicant was concerned.

It has been held that a prior art reference must either be in the field of applicant's endeavor or, if not, then be reasonably pertinent to the particular problem with which the applicant was concerned, in order to be relied upon as a basis for rejection of the claimed invention. See *In re Oetiker*, 977 F.2d 1443, 24 USPQ2d 1443 (Fed. Cir. 1992).

(B) Applicants argue that BERATAN is IMPROPERLY CONSTRUED. The Examiner states that Beratan discloses that polyaniline is a suitable electron donor for a viologen salt acceptor. Beratan does not make any conductive material comprising polyaniline. Beratan shows redox cycling between aniline and viologen monomer units in a polymer using a ruthenium bipyridine intermediate. See, col. 6, lines 1 8-22. Such a composition is far afield from one comprising a viologen salt and polyaniline as distinct substances.

The Examiner respectfully disagrees with this argument. Beratan et al teach that the use of intermediate provides *high* efficiency in moving charge compared to prior art without the use of the intermediate (See column 2, lines 1-2). In other words, the device of Beratan et al would

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still efficiently transfer electron from polyaniline without ruthenium bipyridine intermediate, as in the prior art, but may be not with *high* efficiency.

(C) Applicants argue that Beratan in fact describes a material that is a co-polymer of aniline and viologen, not an article comprising polyaniline and viologen. Accordingly, the combined references in fact make no suggestion of irradiation of an article comprising polyaniline and viologen to obtain a conductive material. FAULTY UNDERSTANDING OF MECHANISM. The Examiner has stated that "photoreduction of a viologen salt by polyaniline occurs by electron transfer when irradiated due to electroconductivity ...". Final Rejection, page 5 (emphasis in original). This statement highlights the Examiner's misunderstanding of the present invention.

Electron transfer is the mechanism of an oxidation-reduction reaction. Electron transfer does not imply conduction, i.e. movement of electrons through a material under the influence of a voltage gradient. As evidence of this distinction, Applicants have provided publications by Kamogawa et al., Sampanthar et al., and Ogawa et al. Kamogawa et al. show the exchange of an electron between a viologen molecule and a halide ion. See, e.g. the reaction scheme below Figure 2 on page 1022. The negatively charged halide ion is converted to a neutral halogen atom, and the positively charged tertiary amine of the viologen is also rendered neutral, with the result that the viologen absorption spectrum changes and the viologen becomes colored. This is a classic example of an oxidation-reduction reaction and also of photochromism as described by Sato. Sampanthar et al. show essentially the same reaction in the instance of viologen grafted to a low density polyethylene substrate. Further information of how poly(vinyl alcohol) (PVA) participates in the photoreduction of viologen is seen in Ogawa et al., which describes the change in color of methyl viologen when it is reduced by absorption of an electron generated by oxidation of PVA by gamma radiation or electron beam radiation (as a model of beta rays). Like the Sato reference, Ogawa et al. do not provide any evidence that any electrical conductivity achieved. In fact, it is highly unlikely, if not impossible for PVA, a non-conjugated polymer, to allow the transport of electrons along its chains. It is certainly not the case that whenever a substance undergoes oxidation, it becomes electrically conductive. It should be noted that all of Sato, Kamogawa, Sampanthar, and Ogawa suggest that the electrons transferred remain localized. There is no suggestion whatsoever that any material is formed that would provide for

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electron flow under an imposed voltage gradient, i.e. that a conductive material would be made. The Examiner argues that it does not matter whether she is right or wrong with respect to whether electron transfer is the same as electroconductivity. She maintains that, regardless of mechanism, the polymeric material of the references would inherently have the same properties as the polymeric material produced in the invention of claim 36. It is true that inherency can bar a patent under U.S. law, but this should be inherency in a *composition actually disclosed in the prior art*, not alleged inherency of a composition that could theoretically be produced by modifying the prior art.

The argument is unconvincing because of the following reasons:

(i) first of all, a polymeric material of Sato et al in view of Williams et al in view of Beratan et al (i.e. *a composition actually disclosed in the prior art*) would have claimed properties, e.g. be electrically conductive, since **it is prepared by a method substantially identical to that of claimed invention**. It is held that where the claimed and prior art products are identical or substantially identical in structure or composition, or are produced by identical or substantially identical processes, claimed properties or functions are presumed to be inherent. See MPEP 2111.02, 2112.01.

(ii) since electroconductivity involves the process of moving available electrons, and since photoreduction of a viologen salt in a combination with polyaniline provides moving electrons, a polymer material containing them becomes electrically conductive, as required by claim 36.

(iii) Williams teach that viologen polymer is electron permeable and charge carrying and can be applied on electrode, i.e. electroconductive.

For the above reasons, it is believed that the rejections should be sustained.

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Respectfully submitted,

Elena Tsoy
Primary Examiner
Art Unit 1762
July 26, 2006

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